the barrier of siliceous rock upon the adjacent mainland. His view that "the Canadian cedar swamp is, then, a phase of WARMING'S calcareous low-moore" appears less probable, and does not seem to explain the frequent presence of *Thuja* in associations with *Larix* in bogs.

It would seem to remain for some one possessing intimate knowledge of the northern forests, but without prejudice for or against the chemical theory of soil control, to harmonize such opposing views as those of HUTCHINSON and FERNALD, by showing that each contributes to the solution of a complex problem, and that the truth lies at neither extreme.—GEO. D. FULLER.

Hybrid vigor.—This subject is brought up to date and ably discussed by JONES[4] in the publication of his latest experiments with corn. The author has continued the inbreeding experiments started by EAST and HAYES. As was predicted, the inbred strains have now reached a condition of almost complete homozygosity, so that further inbreeding no longer brings decrease in vigor, and crossing within the strain brings no increase. The author amplifies somewhat his previously published[5] interpretation of hybrid vigor on the basis of dominance of linked factors.

In addition to the main thesis, some very interesting by-products are discussed. As a practical method of utilizing hybrid vigor in corn, SHULL[6] and others have advised isolating strains A and B and using for seed corn every generation the F_1 grains produced by $A \times B$. A disadvantage of this method lies in the fact that these seeds are usually small, for, although they contain an F_1 embryo, the amount of endosperm is that of the maternal parent (from an inbred, "non-vigorous" race, A or B). Since these seeds are small, the F_1 individuals get a poor start, limiting their expression of hybrid vigor. To overcome this difficulty JONES proposes an intelligent use of 4 selected strains thus: $A \times B$ giving AB; $C \times D$ giving CD; $AB \times CD$ giving the seed corn to be used, which will have sufficient endosperm for a good start and will display hybrid vigor as well.

Carrying further his experiment[7] with mixed foreign and own pollen ("yellow" and "white" pollen), JONES attempted to discover whether there was any selective fertilization in favor of the foreign pollen; this might have been expected from the advantages which foreign pollen brought, as well as from the well-known behavior in self-sterile races. The results, however, pointed consistently in the opposite direction; own pollen was slightly but

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[4] JONES, D. F., The effects of breeding and cross-breeding upon development. Conn. Exper. Sta. Bull. 207. pp. 100. *pls.* 12. 1918.

[5] BOT. GAZ. **56**:70–72. 1918.

[6] SHULL, G. H., Hybridization methods in corn breeding. Amer. Breeders Mag. **1**:98–107. 1910.

[7] JONES, D. F., Bearing of heterosis upon double fertilization. BOT. GAZ. **65**:324–333. *figs.* 3. 1918.

regularly more successful than foreign pollen. "If this is true, crossing is without effect until . . . . the union of the male and female nuclei." In certain of the inbred strains the author records a marked tendency toward dioecism. Some of the inbred strains which maintained the highest ovule development were the most deficient in pollen development, while the exact reverse was true in other strains.

In his general discussion the author suggests that the advantages of hybrid vigor may have played their part in the rise of the sporophyte generation. Certainly if his interpretation of the phenomenon is correct (the reviewer believes it is), the advantages of hybrid vigor would be impossible in the gametophyte generation with its haploid equipment.—MERLE C. COULTER.

Perennating fruit of Cactaceae.—JOHNSON[8] has investigated the remarkable behavior of the fruits of certain Cactaceae, using *Opuntia fulgida* as material. The fruits of these Cactaceae remain attached to the plant and actively growing for several or many years. The fruit of *O. fulgida* not only remains attached, unripened, and steadily growing, but the seeds are never shed from the fruit. In addition to this, the matured fruit, or even the ovary of the unripened flower, may give rise to secondary flowers and so to other fruits. As many as 4 or 5 generations of flowers and fruits may thus be formed in a single season. If a mature fruit falls on moist soil, it may develop adventitious roots and shoots and thus initiate a new plant.

The early development of the ovary resembles that of a young vegetative joint, and is entirely stemlike in appearance, with its evanescent leaves, tubercles, and axillary areoles. It is evident, for many reasons, that the whole outer wall of the ovary and fruit is morphologically of stem origin. The continuous formation of flowers is remarkable, as indicated by the following description: "From the axillary buds, or areoles, of the primary flowers that open in May, arise secondary flowers which open in June. From areoles of these, in turn, tertiary flowers open in July, and on the latter quaternary flowers bloom forth in August."

The contribution contains much interesting material that cannot be included in a brief review, but it all presents the unusual habits of a remarkable group of plants.—J. M. C.

Alaria.—YENDO[9] has published a monograph of *Alaria* which is remarkably full in its details and noteworthy in the quality of its plates. The introductory pages deal with the morphology of the genus, every region of the plant being considered, and the development and life history presented, so that the

[8] JOHNSON, DUNCAN S., The fruit of *Opuntia fulgida*. A study of perennation and proliferation in the fruits of certain Cactaceae. Publ. Carnegie Inst. pp. 62. *pls. 12*. 1918.

[9] YENDO, KICHISABURO, A monograph of the genus *Alaria*. Jour. Coll. Sci. Univ. Tokyo **43**:1–145. *pls. 19*. 1919.